PATENT ABSTRACTS OF JAPAN

(11)Publication number : 06-074313

(43)Date of publication of application : 15.03.1994

(51)Int.Cl. F16H 13/08

(21)Application number : 04-334233

(22)Date of filing : 15.12.1992

(71)Applicant : KOYO SEIKO CO LTD

(72)Inventor : IWAMOTO HITOSHI
UEDA KOICHI
YASUHARA SHINJI

(30)Priority

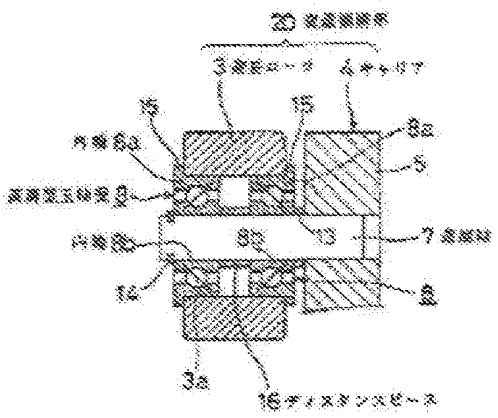
Priority number : 04 45595 Priority date : 30.06.1992 Priority country : JP

(54) PLANETARY ROLLER TRANSMISSION AND MULTISTAGE STRUCTURED PLANETARY ROLLER TRANSMISSION

(57)Abstract:

PURPOSE: To simply and accurately adjust preload to a deep groove ball bearing for supporting a planetary roller in a planetary roller transmission.

CONSTITUTION: Flanges 15 and 15 extending in a radial and outward direction are provided on an external peripheral portion on one axial direction end side of each of the outer rings 8a and 8a of the deep groove ball bearings 8 and 8 provided between a planetary roller 3 and a planetary shaft 7. These flanges 15 and 15 are made to abut on both ends of the planetary roller 3, causing the outer rings 8a and 8a not to move. On the other hand, a cylindrical distance piece 16 which is shorter than the space between the outer rings 8a and 8a is secured on the outer periphery of the planetary shaft 7 in the area between both inner rings 8b and 8b. These inner rings 8b and 8b are axially compressed by the spacer 13 and E ring 14 arranged on both sides of the inner rings 8b and 8b, causing the bearings 8 and 8 to be preloaded.



* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]Have a speed change mechanism part provided between a fixed wheel, a sun shaft concentrically inserted in a fixed wheel, and a fixed wheel and a sun shaft, and and said speed change mechanism part, Two or more planetary rollers in which it intervenes by a press contact state between a fixed wheel and a sun shaft, Said career has planetary shafts of a planetary roller and the same number including a career which rotates synchronizing with revolution operation of each planetary roller, It is a planetary roller type power transmission device of composition of that each planetary shafts are inserted in an inner hole of each planetary roller via at least two deep groove type ball bearings arranged in shaft orientations, and both outer rings of spiral wound gasket of two deep groove type ball bearings in a speed change mechanism part have a flange prolonged in a method of the outside of a diameter direction at the outside end, respectively.
Where these both outer rings of spiral wound gasket are isolated between predetermined in shaft orientations, while having attached a planetary roller in the shape of immobilization among both flanges of this outer ring of spiral wound gasket, a field between shaft orientations of both inner rings of said two deep groove type ball bearings -- a periphery of planetary shafts -- said alienation of said both outer rings of spiral wound gasket -- a planetary roller type power transmission device characterized by what is being made to give necessary compressive force to shaft orientations to said both inner rings in the state where it equipped with a cylindrical member whose shaft-orientations length is shorter than an interval.

[Claim 2]While establishing two or more steps of said speed change mechanism part in shaft-orientations next door doubling, a sun shaft is made inscribed in each planetary roller of a speed change mechanism part of the highest speed gear, A shank of a career of a speed change mechanism part of this highest speed gear is made inscribed in each planetary roller as a sun shaft of a speed change mechanism part of the next step, A planetary roller type power transmission device of a multilevel structure characterized by

what it is a planetary roller type power transmission device of a multilevel structure which used a shank of a career of a speed change mechanism part of the minimum speed gear as a low-speed output shaft, and a speed change mechanism part of a low speed stage is considered for as the feature composition of Claim 1 at least.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention relates to a planetary roller type power transmission device and the planetary roller type power transmission device of a multilevel structure.
[0002]
[Description of the Prior Art]The planetary roller type power transmission device is provided with the speed change mechanism part 20 provided between the fixed wheel 1 fixed to the housing 9, the sun shaft 2 concentrically inserted in the fixed wheel 1, and the fixed wheel 1 and the sun shaft 2 as shown in drawing 2. Two or more planetary rollers 3 with which they intervene in the speed change mechanism part 20 by a press contact state between the fixed wheel 1 and the sun shaft 2, Including the career 4 which rotates synchronizing with revolution operation of the planetary roller 3, the career 4, The circular carrier plate 5 and the shank 6 attached to the center of this carrier plate 5 in one, It has two or more planetary shafts 7 which are attached to several circumferences by the side of the periphery of the carrier plate 5 in one, and are inserted in the inner hole 3a of each planetary roller 3 via the two deep groove type ball bearings 8 and 8.
[0003]The above-mentioned sun shaft 2 and the shank 6 of the career 4 are supported by the housing 9 via the anti-friction bearings 10 and 11, enabling free rotation, an input shaft is attached to either and an output shaft is attached to the other. The sun shaft 2 and the shank 6 may be formed in an input shaft or an output shaft, and one.
[0004]Since play between the planetary roller 3 and the planetary shafts 7 of the career 4 is equivalent to the backlash of gear mechanics in such a planetary roller type power transmission device of composition, it is desirable to lessen the above-mentioned play. This play consists of a crevice between the planetary roller 3 and the deep groove type ball bearing 8, and an internal gap of the deep groove type ball bearing 8 fundamentally. By the way, in order to make the planetary roller 3 weld by pressure to the fixed wheel 1 and the sun shaft 2, he establishes few crevices positively between the planetary roller 3 and the deep groove type ball bearing 8, and is trying to sag the planetary roller 3 between the fixed

wheel 1 and the sun shaft 2 on a function. That is, since the crevice between the planetary roller 3 and the deep groove type ball bearing 8 is to some extent required, in order to lessen play between the planetary roller 3 and the planetary shafts 7 of the career 4 as much as possible, a method only has reducing the internal gap of the deep groove type ball bearing 8.

[0005]In order to reduce the internal gap of this deep groove type ball bearing 8, the method of giving precompression to the bearing concerned is suitable. In order to give this precompression, as shown in drawing 7, by the former, C ring 12 is intervened among each outer rings of spiral wound gasket 8a and 8a of the two deep groove type ball bearings 8 and 8, It changed into the state where it inserted that it was also in the spacer 13 and E ring 14 about each inner rings of spiral wound gasket 8b and 8b of the two deep groove type ball bearings 8 and 8 from the both sides, and by setting up suitably the amount of insertion of the planetary shafts 7 to the insertion hole of the carrier plate 5, shaft orientations were made to compress both the inner rings of spiral wound gasket 8b and 8b, and it has gone.

[0006]

[Problem(s) to be Solved by the Invention]In the above-mentioned conventional example, although it is made to perform precompression adjustment to the deep groove type ball bearing 8 in the amount of insertion of the planetary shafts 7 to the insertion hole of the carrier plate 5, when performing minute precompression adjustment, the error of the working dimension of C ring 12, etc. must be adjusted, or degree operation of the insertion of the planetary shafts 7 must be carried out delicately. Since such degree operation is very difficult, it can be said to be almost impossible [exact precompression adjustment]. If precompression management cannot be made exact, running torque change takes place and it leads to a lost motion when right-reverse-reversing a hand of cut.

[0007]By the way, there is a planetary roller type power transmission device of the multilevel structure which combines two or more steps of above-mentioned speed change mechanism parts 20 with shaft-orientations next door doubling, and obtained the big change gear ratio. For example, a sun shaft (high-speed output shaft) is made inscribed in each planetary roller of the speed change mechanism part of a high speed stage in the case of two steps, The shank of the career of the speed change mechanism part of this high speed stage is made inscribed in each planetary roller as a sun shaft of the speed change mechanism part of the next step, and let the shank of the career of the speed change mechanism part of a low speed stage be a low-speed output shaft. the deep groove type ball bearing 8 in the speed change mechanism part 20 of each stage in case of such a multilevel structure, in each precompression management coming apart easily and using especially as reduction gears of a minute feeding device, Although the running torque change by play increases inevitably and delivery in a minute unit is needed by the transmitting power from a speed change mechanism part to the speed change mechanism part of a low speed stage of a high speed stage, it becomes easy to generate an error.

[0008]It was originated in view of such a situation, and this invention makes it SUBJECT to

enable it to perform simply and correctly precompression adjustment to the deep groove type ball bearing for planetary roller support. This invention manages correctly the precompression of the deep groove type ball bearing in the speed change mechanism part of a low speed stage at least in the planetary roller type power transmission device of a multilevel structure, When using especially as reduction gears of a minute feeding device, it is making into SUBJECT enabling it to reduce the misfeed difference in the microscopic unit which poses a problem.

[0009]

[Means for Solving the Problem]In order to attain such SUBJECT, this invention, Two or more planetary rollers in which it intervenes by a press contact state between a fixed wheel, a sun shaft concentrically inserted in a fixed wheel, and a fixed wheel and a sun shaft, a career which rotates synchronizing with revolution operation of each planetary roller, [have and] Said career has planetary shafts of a planetary roller and the same number, and takes the following composition in a planetary roller type power transmission device of composition of that each planetary shafts are inserted in an inner hole of each planetary roller via at least two deep groove type ball bearings arranged in shaft orientations.

[0010]In a planetary roller type power transmission device of this invention, both outer rings of spiral wound gasket of two deep groove type ball bearings in a speed change mechanism part have a flange prolonged in a method of the outside of a diameter direction at the outside end, respectively, Where these both outer rings of spiral wound gasket are isolated between predetermined in shaft orientations, while having attached a planetary roller in the shape of immobilization among both flanges of this outer ring of spiral wound gasket, a field between shaft orientations of both inner rings of said two deep groove type ball bearings -- a periphery of planetary shafts -- said alienation of said both outer rings of spiral wound gasket -- it had composition which is making necessary compressive force give shaft orientations to said both inner rings in the state where it equipped with a cylindrical member whose shaft-orientations length is shorter than an interval.

[0011]While providing two or more steps of above-mentioned speed change mechanism parts in shaft-orientations next door doubling, a sun shaft is made inscribed in each planetary roller of a speed change mechanism part of the highest speed gear, A shank of a career of a speed change mechanism part of this highest speed gear is made inscribed in each planetary roller as a sun shaft of a speed change mechanism part of the next step, By using a shank of a career of a speed change mechanism part of the minimum speed gear as a low-speed output shaft, a planetary roller type power transmission device of a multilevel structure is constituted, and it is good at least also considering a speed change mechanism part of a low speed stage as the above-mentioned feature composition.

[0012]

[Function]namely, the shaft-orientations length of the cylindrical member infixed among both inner rings -- the shaft orientations of both outer rings of spiral wound gasket -- alienation -- if it is made shorter than an interval, a crevice will come be made between the

inner end surface of both inner rings, and the both-ends side of a cylindrical member. For this reason, when the compressive force of shaft orientations is given to two inner rings of spiral wound gasket, both inner rings of spiral wound gasket will be made to be displaced by the direction which approaches about a part for said crevice, and precompression will be given to two deep groove type ball bearings.

[0013]Thus, it has come to be able to perform precompression adjustment by adjusting the amount of displacement of both inner rings of spiral wound gasket. That is, the power which can specify now the precompression given only by adjusting the shaft-orientations length rate of a cylindrical member, and is going to compress the above-mentioned does not have to carry out degree operation.

[0014]In the planetary roller type power transmission device of the multilevel structure of this invention, since the precompression adjustment about the speed change mechanism part of a low speed stage which play influences greatly can manage properly as mentioned above when using it as reduction gears of a minute feeding device, a misfeed difference can be reduced.

[0015]

[Example]The fundamental composition of the planetary roller type power transmission device of this example is the same as drawing 2 explained by the conventional example. That is, in a figure, the fixed wheel in which 1 is fixed to the housing 9, the sun shaft by which 2 was concentrically inserted in the fixed wheel 1, and 20 are speed change mechanism parts provided between the fixed wheel 1 and the sun shaft 2. Two or more planetary rollers 3 with which they intervene in the speed change mechanism part 20 by a press contact state between the fixed wheel 1 and the sun shaft 2, Including the career 4 which rotates synchronizing with revolution operation of the planetary roller 3, the career 4, The circular carrier plate 5 and the shank 6 attached to the center of this carrier plate 5 in one, It has two or more planetary shafts 7 which are attached to several circumferences by the side of the periphery of the carrier plate 5 in one, and are inserted in the inner hole 3a of each planetary roller 3 via the two deep groove type ball bearings 8 and 8.

[0016]The important section of the speed change mechanism part is shown in drawing 1. The flanges 15 and 15 to which the deep groove type ball bearings 8 and 8 of this example extend outward [diameter direction] to the axial end side outer peripheral part of the outer rings of spiral wound gasket 8a and 8a are formed.

The process tolerance of each medial surface of these flanges 15 and 15 is set up identically to the process tolerance of the end face of the planetary roller 3.

The periphery of the planetary shafts 7 is equipped with the distance piece 16 of the cylindrical shape in the field between each inner rings of spiral wound gasket 8b and 8b of both the deep groove type ball bearings 8 and 8. The point inserted from the both sides as it is also in the spacer 13 and E ring 14 about each inner rings of spiral wound gasket 8b and 8b of the two deep groove type ball bearings 8 and 8 is not different from a conventional example.

[0017]the distance piece 16 responds to the precompression which should be given to the deep groove type ball bearing 8 -- the shaft orientations between both the outer rings of spiral wound gasket 8a and 8a -- alienation -- an interval -- shaft-orientations length -- a necessary size -- it is set up short. that is, the shaft-orientations length of this distance piece 16 -- the shaft orientations between both the outer rings of spiral wound gasket 8a and 8a -- alienation -- the precompression given to the deep groove type ball bearings 8 and 8 is adjusted by adjusting the rate which also shortens the axial length halfbeak of an interval.
[0018]Next, the operation at the time of precompression adjustment is explained. First, the end face of the planetary roller 3 is made to carry out contact arrangement of the medial surface of the flanges 15 and 15 of both the outer rings of spiral wound gasket 8a and 8a so that it cannot move to the direction which both the outer rings of spiral wound gasket 8a and 8a of the two deep groove type ball bearings 8 and 8 approach. At this time, since each end face is processed with sufficient accuracy, size setting is carried out correctly and it deals in the distance between the end faces of the planetary roller 3 (planetary roller length), and the distance between the end faces of both the outer rings of spiral wound gasket 8a and 8a (outer-ring-of-spiral-wound-gasket length). subsequently -- comparing the length of the distance piece 16 with both the outer rings of spiral wound gasket 8a by which size setting is carried out correctly, and the shaft-orientations clearance between 8a -- a request size -- it sets up short and the planetary roller 3 is attached to the planetary shafts 7 of a free state. after assembling in this way, the planetary shafts 7 are stuffed into the insertion hole of the carrier plate 5 until full.
[0019]Thus, if the planetary shafts 7 are pushed in, You are made to be displaced so that it may be compressed about a part for the suitable crevice provided between each [of both the medial surfaces of both the inner rings of spiral wound gasket 8b and 8b, and the distance piece 16] that both the inner rings of spiral wound gasket 8b and 8b are also in the spacer 13 and E ring 14 of the both sides and shaft orientations may be approached. On the other hand, since the flanges 15 and 15 of both the outer rings of spiral wound gasket 8a and 8a are made to contact the both-ends side of the planetary roller 3, the precompression according to the quantity in which the inner rings 8b and 8b were displaced comes to be given to the deep groove type ball bearings 8 and 8.
[0020]Thus, in the case of this example, the precompression given to the deep groove type ball bearings 8 and 8 can be exactly set up only by specifying the length of the distance piece 16 by operating it so that the planetary shafts 7 may be stuffed into it until it stops to the insertion hole of the carrier plate 5.
[0021]Working example of the planetary roller type power transmission device of the multilevel structure of this invention is shown in drawing 3.
[0022]With the planetary roller type power transmission device of a multilevel structure, in short, two or more steps of speed change mechanism parts 20 which were mentioned above are combined with shaft-orientations next door doubling, and a big change gear ratio is obtained. In the example of a figure, three steps of speed change mechanism parts 20A,

20B, and 20C are formed in shaft-orientations next door doubling, the planetary roller 3 of the speed change mechanism part 20A of a high speed stage (left-in-the-figure side) -- it being alike, respectively, and the sun shaft 2 being made inscribed in, and, the shank 6 of the career 4 of the speed change mechanism part 20A of this high speed stage -- as the sun shaft of the speed change mechanism part 20B of the medium-speed stage (middle in a figure) -- the planetary roller 3 -- it is alike, respectively, and you make it inscribed in and the shank 6 of the career 4 of the speed change mechanism part 20C of a low speed stage (figure Nakamigi side) is used as the low-speed output shaft. Especially in this example, only mounting structure of the deep groove type ball bearing 8 in the speed change mechanism part 20C of a low speed stage is made the same as what is shown in drawing 1 among three steps of speed change mechanism parts 20A, 20B, and 20C, and it is made the same as what is shown in drawing 4 about other speed change mechanism parts 20A and 20B. Of course, it may be made the same as what may make only mounting structure of the deep groove type ball bearing 8 in all the speed change mechanism parts 20A, 20B, and 20C the same as what is shown in drawing 1, and shows drawing 1 only the speed change mechanism parts 20C and 20B of a low speed stage and the medium-speed stage. Although the individual fixed wheels 1A, 1B, and 1C are used for each stage, these may be constituted in one. Although the annular plate 5 and the shank 6 of the career 4 are united in the example of a figure, it may constitute in a different body similarly [the example of drawing 2].

[0023]Although it is considered as three steps of speed change structures in the above-mentioned example, the number of stages in particular is not limited. In the planetary roller type power transmission device of a multilevel structure, at least the deep groove type ball bearing 8 of the speed change mechanism part 20C of a low speed stage as composition using the outer ring of spiral wound gasket 8a without the flange 15, Instead, elastic bodies, such as adhesives, may be intervened in the infinitesimal gap provided between the planetary roller 3 and the deep groove type ball bearing 8. In this case, play between the planetary roller 3 and the planetary shafts 7 will be reduced as it is also at the elasticity of adhesives, and running torque change can be controlled now like structure as shown in above-mentioned drawing 3 as a result.

[0024]Here, when using the deep groove type ball bearing of the collar head shown in drawing 1, although not illustrated, the relation between the torsion torque of an output shaft (shank 6 of the career 4) when using as reduction gears, and angle of torsion is shown in the graph of drawing 4 and drawing 5 about the case where the above-mentioned adhesives are used, respectively. The torsal rigidity (relation between output-shaft torsion torque and output-shaft angle of torsion) about the case where a deep groove type ball bearing without a flange is used like a conventional example is shown in the graph of drawing 6. The result obtained by repeating the snatch back action which makes right and an opposite direction reverse the sun shaft 2 used as an input shaft is expressed with these graphs.

It means that torsal rigidity is so high that there is little inclination.
In this snatch back action, the direction of a forward/reverse rotation is output-shaft load torque max3.0 [N-m] it has given until. As a result, torsal rigidity is $0.554x10^{-3}$, when using the deep groove type ball bearing of a collar head. [rad/N-M] It is 1.04 when using adhesives. [rad/N-M] It is 1.36 when using a deep groove type ball bearing without a flange. [rad/N-M] it becomes clear that torsal rigidity is markedly alike and improves in case of the case where a next door and the deep groove type ball bearing of a collar head are used.
[0025]The using device in the case where the deep groove type ball bearing of a collar head is used, The using device in the case where the outer diameter of 31.111 mm and the sun shaft 2 shall be 7.778 mm the outer diameter of 70 mm and the planetary roller 3 for the inside diameter of the fixed wheel 1, and a deep groove type ball bearing without a flange is used, The amount of backlash in the shank 6 of the career 4 which is setting the outer diameter of 10 mm and the planetary roller 3 to 20 mm, and serves as [outer diameter / of 50 mm and the sun shaft 2] an output shaft in the inside diameter of the fixed wheel 1 is $1.6x10^{-5}$, when using the deep groove type ball bearing of a collar head. [rad (3.45 seconds)] It has been 42.7 seconds, when using adhesives and using a deep groove type ball bearing without a flange for 2.87 seconds. Thus, even when mentioning however making into an identical size the case where sizes differ for every using device, it is thought that it becomes the almost same tendency as the above-mentioned.
[0026]
[Effect of the Invention]this invention -- the shaft orientations between both outer rings of spiral wound gasket -- alienation -- the rate of the shaft-orientations length of a cylindrical member over an interval is specified arbitrarily.
Therefore, the precompression given to two deep groove type ball bearings can be adjusted.
That is, by this invention, it excels in practicality, in that precompression adjustment can be performed simply and correctly, even if precompression can be exactly set up only by specifying the shaft-orientations length of a cylindrical member, without carrying out degree operation of the axial compression force of inner rings of spiral wound gasket delicately, and it is not an expert. For this reason, the assembling time of a planetary roller type power transmission device can be shortened, and it can contribute to a productivity rise.
[0027]In the planetary roller type power transmission device of the multilevel structure of this invention, since the precompression adjustment about the speed change mechanism part of a low speed stage which play influences greatly can manage properly as mentioned above when using it as reduction gears of a minute feeding device, a misfeed difference can be reduced.

[Translation done.]

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-314459
(43)Date of publication of application : 14.11.2000

(51)Int.Cl. F16H 13/08

(21)Application number : 11-122434
(22)Date of filing : 28.04.1999

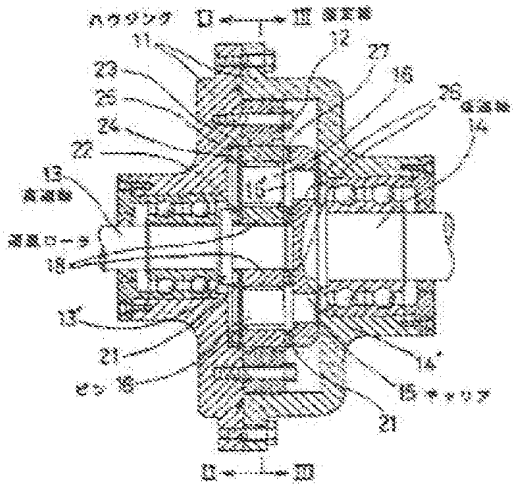
(71)Applicant : NTN CORP
(72)Inventor : KAWASE TATSUO
FUKUSHIMA SHIGEAKI
MAKINO TOMOAKI
BANDO HIROMICHI

(54) PLANETARY ROLLER TYPE POWER TRANSMISSION DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To reduce a friction work at a planetary roller type power transmission device and to prevent early breakage of a device due to lowering of the transmission efficiency of the device as while and wear of a planetary roller end face and a guide surface.

SOLUTION: This power transmission device comprises a fixed ring 12, a high speeds haft 13 coaxially arranged op the inside thereof, a plurality of planetary rollers 18 located in a pressure contact state between the fixed ring 12 and the high speed shaft 13, and a carrier 15 filled with pins 16 rotatably supporting the planetary roller 18 at equal intervals in a peripheral direction through a bearing. In a planetary roller type power transmission device, wherein the carrier 15 is formed integrally with a low speed shaft 14, by locating bearing members 22, 24, and 26 between the end face of the planetary roller 18, and a member making contact therewith, movement in an axial direction of the planetary roller 18 is regulated.



* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]A planetary roller type power transmission device regulating movement of shaft orientations of a planetary roller by having the following and making a bearing member intervene between the end face of a planetary roller, and a member which contacts this in a planetary roller type power transmission device with which a career was united with a low speed shaft.
A fixed wheel.
A high speed shaft allotted by the same axle inside a fixed wheel.
Two or more planetary rollers which intervene by a press contact state between a fixed wheel and a high speed shaft.
A career which implanted in circumferencial direction regular intervals a pin which supports a planetary roller via a bearing enabling free rotation.

[Claim 2]The planetary roller type power transmission device according to claim 1, wherein a bearing member which intervenes between a planetary roller and a member which contacts this is thrust needle roller bearing.
[Claim 3]The planetary roller type power transmission device comprising according to claim 2:
Needle roller bearing of two size to which the above-mentioned bearing member contacts the end face of a planetary roller by the side of a high speed shaft.
Needle roller bearing allotted to each end face of a planetary roller by the side of a low speed, respectively.

[Claim 4]The planetary roller type power transmission device according to claim 1 using a bearing member which intervenes between the end face of a planetary roller, and a housing end face at least as plain bearing which has self lubricity.

Ref 4

105244

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号

特開平6－74313

(43)公開日　平成6年(1994)3月15日

(51)Int.Cl.[5]	識別記号	庁内整理番号	Ｆ Ｉ	技術表示箇所
Ｆ１６Ｈ　13/08		Ｅ　8009－3Ｊ		

審査請求　未請求　請求項の数２(全　８　頁)

(21)出願番号　特願平4－334233

(22)出願日　平成４年(1992)12月15日

(31)優先権主張番号　実願平4－45595

(32)優先日　平４(1992)６月30日

(33)優先権主張国　日本（ＪＰ）

(71)出願人　000001247
光洋精工株式会社
大阪府大阪市中央区南船場３丁目５番８号

(72)発明者　岩本　仁
大阪市中央区南船場三丁目５番８号　光洋精工株式会社内

(72)発明者　上田　浩一
大阪市中央区南船場三丁目５番８号　光洋精工株式会社内

(72)発明者　安原　伸二
大阪市中央区南船場三丁目５番８号　光洋精工株式会社内

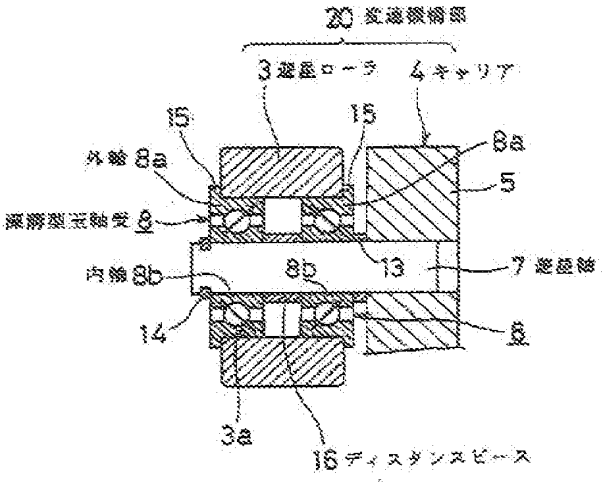
(74)代理人　弁理士　岡田　和秀

(54)【発明の名称】　遊星ローラ式動力伝達装置および多段構造の遊星ローラ式動力伝達装置

(57)【要約】

【目的】遊星ローラ式動力伝達装置において，遊星ローラ支持用の深溝型玉軸受に対する予圧調整を簡単かつ正確に行えるようにすること。

【構成】遊星ローラ３と遊星軸７との間に介装される深溝型玉軸受８，８の外輪８ａ，８ａの軸方向一端側外周部位には、径方向外向きに延出するフランジ１５，１５が設けられている。このフランジ１５，１５は遊星ローラ３の両端面に当接させられており、それにより外輪８ａ，８ａは不動となっている。一方、両内輪８ｂ，８ｂの間の領域で遊星軸７の外周には、外輪８ａ，８ａ間の軸方向離間間隔よりも短い円筒形のディスタンスピース１６が装着されている。この内輪８ｂ，８ｂどうしがその両側に配置のスペーサ１３およびＥリング１４でもって軸方向に圧縮させられることにより，軸受８，８に予圧が付与されている。



1

【特許請求の範囲】

【請求項１】　固定輪と、固定輪に同心状に挿通された太陽軸と、固定輪と太陽軸との間に設けられる変速機構部とを備え、かつ、前記変速機構部は、固定輪と太陽軸との間に圧接状態で介入される複数個の遊星ローラと、各遊星ローラの公転動作に同期して回転するキャリアとを含み、前記キャリアは遊星ローラと同数の遊星軸を有し、各遊星軸が各遊星ローラの内孔に軸方向に並べた少なくとも二つの深溝型玉軸受を介して挿入される構成の遊星ローラ式動力伝達装置であって、

変速機構部における二つの深溝型玉軸受の両外輪がそれぞれ外側の端部に径方向外方に延びるフランジを有しており、該両外輪が軸方向に所定間隔離された状態で該外輪の両フランジ間に遊星ローラを不動状に取り付けているとともに、

前記二つの深溝型玉軸受の両内輪の軸方向の間の領域で遊星軸の外周に、前記両外輪の前記離間間隔よりも軸方向長さが短い円筒部材を装着した状態で、前記両内輪に対して軸方向に所要の圧縮力を付与させている、ことを特徴とする遊星ローラ式動力伝達装置。

【請求項２】　前記変速機構部を軸方向隣り合わせに複数段設けるとともに、最高速段の変速機構部の遊星ローラそれぞれに太陽軸を内接させて、この最高速段の変速機構部のキャリアの軸部を次段の変速機構部の太陽軸として遊星ローラそれぞれに内接させ、最低速段の変速機構部のキャリアの軸部を低速の入出力軸とした多段構造の遊星ローラ式動力伝達装置であって、

少なくとも低速段の変速機構部を請求項１の特徴構成としている、ことを特徴とする多段構造の遊星ローラ式動力伝達装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、遊星ローラ式動力伝達装置および多段構造の遊星ローラ式動力伝達装置に関する。

【０００２】

【従来の技術】遊星ローラ式動力伝達装置は、図２に示すように、ハウジング９に固定される固定輪１と、固定輪１に同心状に挿通された太陽軸２と、固定輪１と太陽軸２との間に設けられる変速機構部２０とを備えている。変速機構部２０は、固定輪１と太陽軸２との間でそれらに圧接状態で介入される複数個の遊星ローラ３と、遊星ローラ３の公転動作に同期して回転するキャリア４とを含み、キャリア４は、円形のキャリアプレート５と、このキャリアプレート５の中心に一体的に取り付けられる軸部６と、キャリアプレート５の外周側の円周数箇所に一体的に取り付けられかつ各遊星ローラ３の内孔３ａに二つの深溝型玉軸受８，８を介して挿入される複数本の遊星軸７とを有している。

【０００３】前述の太陽軸２とキャリア４の軸部６とは、ハウジング９に転がり軸受１０，１１を介して回転自在に支持されており、いずれか一方に入力軸が、他方に出力軸が取り付けられる。なお、太陽軸２と軸部６は、入力軸または出力軸と一体に形成されることもある。

2

【０００４】このような構成の遊星ローラ式動力伝達装置では、遊星ローラ３とキャリア４の遊星軸７との間の遊びが歯車機構のバックラッシに相当するので、前述の遊びを少なくするのが望ましい。この遊びは、基本的に遊星ローラ３と深溝型玉軸受８との間の隙間と深溝型玉軸受８の内部隙間とからなる。ところで、機能上、固定輪１と太陽軸２とに対して遊星ローラ３を圧接させる必要があるため、遊星ローラ３と深溝型玉軸受８との間に積極的に僅かな隙間を設けて固定輪１と太陽軸２との間で遊星ローラ３をたわませるようにしている。つまり、遊星ローラ３と深溝型玉軸受８との間の隙間はある程度必要なものであるから、遊星ローラ３とキャリア４の遊星軸７との間の遊びを極力少なくするには、深溝型玉軸受８の内部隙間を減らすしか方法はない。

【０００５】この深溝型玉軸受８の内部隙間を減らすには、当該軸受に対して予圧を与える方法が適している。この予圧を付与するため、従来では、図７に示すように、二つの深溝型玉軸受８，８の各外輪８ａ，８ａの間にＣリング１２を介入し、二つの深溝型玉軸受８，８の各内輪８ｂ，８ｂをその両側からスペーサ１３およびＥリング１４でもって挟んだ状態とし、キャリアプレート５の挿通孔への遊星軸７の嵌入量を適当に設定することにより両内輪８ｂ，８ｂを軸方向に圧縮させて行っている。

【０００６】

【発明が解決しようとする課題】上記従来例では、深溝型玉軸受８に対する予圧調整をキャリアプレート５の挿通孔への遊星軸７の嵌入量で行うようにしているが、微小な予圧調整を行う場合にはＣリング１２の加工寸法の誤差などを調整したり、遊星軸７の嵌入を微妙に加減操作せねばならない。このような加減操作は非常に困難であるため、正確な予圧調整はほとんど不可能であると言える。予圧管理を的確にできなければ、回転トルク変動が起こり、回転方向を正逆反転させるときのロストモーションにつながる。

【０００７】ところで、前述の変速機構部２０を軸方向隣り合わせに複数段結合して大きな変速比を得るようにした多段構造の遊星ローラ式動力伝達装置がある。例えば２段の場合、高速段の変速機構部の遊星ローラそれぞれに太陽軸（高速の入出力軸）を内接させて、この高速段の変速機構部のキャリアの軸部を次段の変速機構部の太陽軸として遊星ローラそれぞれに内接させ、低速段の変速機構部のキャリアの軸部を低速の入出力軸とする。このような多段構造だと、各段の変速機構部２０における深溝型玉軸受８それぞれの予圧管理がばらばらになり

やすく、特に微小送り装置の減速機として利用する場合には、高速段の変速機構部から低速段の変速機構部への動力伝達によって必然的に遊びによる回転トルク変動が増大して、微小な単位での送りが必要になるにもかかわらず誤差が発生しやすくなる。

【０００８】本発明は、このような事情に鑑みて創案されたもので、遊星ローラ支持用の深溝型玉軸受に対する予圧調整を簡単かつ正確に行えるようにすることを課題としている。また、本発明は、多段構造の遊星ローラ式動力伝達装置において、少なくとも低速段の変速機構部における深溝型玉軸受の予圧を正確に管理して、特に微小送り装置の減速機として利用する場合に問題となる微小単位での送り誤差を低減できるようにすることを課題としている。

【０００９】

【課題を解決するための手段】このような課題を達成するために、本発明は、固定輪と、固定輪に同心状に挿通された太陽軸と、固定輪と太陽軸との間に圧接状態で介入される複数個の遊星ローラと、各遊星ローラの公転動作に同期して回転するキャリアとを備え、かつ、前記キャリアは遊星ローラと同数の遊星軸を有し、各遊星軸が各遊星ローラの内孔に軸方向に並べた少なくとも二つの深溝型玉軸受を介して挿入される構成の遊星ローラ式動力伝達装置において、次のような構成をとる。

【００１０】本発明の遊星ローラ式動力伝達装置では、変速機構部における二つの深溝型玉軸受の両外輪がそれぞれ外側の端部に径方向外方に延びるフランジを有しており、該両外輪が軸方向に所定間隔離された状態で該外輪の両フランジ間に遊星ローラを不動状に取り付けているとともに、前記二つの深溝型玉軸受の両内輪の軸方向の間の領域で遊星軸の外周に、前記両外輪の前記離間間隔よりも軸方向長さが短い円筒部材を装着した状態で、前記両内輪に対して軸方向に所要の圧縮力を付与させている構成とした。

【００１１】前述の変速機構部を軸方向隣り合わせに複数段設けるとともに、最高速段の変速機構部の遊星ローラそれぞれに太陽軸を内接させて、この最高速段の変速機構部のキャリアの軸部を次段の変速機構部の太陽軸として遊星ローラそれぞれに内接させ、最低速段の変速機構部のキャリアの軸部を低速の入出力軸とすることにより多段構造の遊星ローラ式動力伝達装置を構成し、少なくとも低速段の変速機構部を前述の特徴構成としてもよい。

【００１２】

【作用】すなわち、両内輪間に介装する円筒部材の軸方向長さを両外輪の軸方向離間間隔よりも短くしていれば、両内輪の内端面と円筒部材の両端面との間に隙間ができるようになる。このため、二つの内輪に軸方向の圧縮力を付与すると、両内輪は前記隙間分について近接する向きに変位させられることになり、二つの深溝型玉軸受に予圧が付与されることになる。

【００１３】このように両内輪の変位量を調整することによって予圧調整ができるようになっている。つまり、円筒部材の軸方向長さ割合を調整するだけで付与する予圧を特定できるようになっていて、前述の圧縮しようとする力は加減操作する必要がない。

【００１４】また、本発明の多段構造の遊星ローラ式動力伝達装置では、それを微小送り装置の減速機として利用する場合、遊びが大きく影響する低速段の変速機構部についての予圧調整が前述のように適正に管理できるようになるから、送り誤差を低減できるようになる。

【００１５】

【実施例】本実施例の遊星ローラ式動力伝達装置の基本的な構成は、従来例で説明した図２と同じである。すなわち、図において、１はハウジング９に固定される固定輪、２は固定輪１に同心状に挿通された太陽軸、２０は固定輪１と太陽軸２との間に設けられる変速機構部である。変速機構部２０は、固定輪１と太陽軸２との間でそれらに圧接状態で介入される複数個の遊星ローラ３と、遊星ローラ３の公転動作に同期して回転するキャリア４とを含み、キャリア４は、円形のキャリアプレート５と、このキャリアプレート５の中心に一体的に取り付けられる軸部６と、キャリアプレート５の外周側の円周数箇所に一体的に取り付けられかつ各遊星ローラ３の内孔３ａに二つの深溝型玉軸受８，８を介して挿入される複数本の遊星軸７とを有している。

【００１６】図１に変速機構部の要部を示している。本実施例の深溝型玉軸受８，８は、その外輪８ａ，８ａの軸方向一端側外周部位に径方向外向きに延出するフランジ１５，１５が設けられており、このフランジ１５，１５の各内側面の加工精度は遊星ローラ３の端面の加工精度と同一に設定されている。また、両深溝型玉軸受８，８の各内輪８ｂ，８ｂの間の領域で遊星軸７の外周には円筒形のディスタンスピース１６が装着されている。なお、二つの深溝型玉軸受８，８の各内輪８ｂ，８ｂをその両側からスペーサ１３およびＥリング１４でもって挟んでいる点は従来例と変わらない。

【００１７】ディスタンスピース１６は、深溝型玉軸受８に付与すべき予圧に応じて両外輪８ａ，８ａ間の軸方向離間間隔よりも軸方向長さが所要寸法短く設定される。つまり、このディスタンスピース１６の軸方向長さを両外輪８ａ，８ａ間の軸方向離間間隔の軸方向長さよりも短くする割合を調整することにより、深溝型玉軸受８，８に付与する予圧を調整するようになっている。

【００１８】次に、予圧調整時の動作を説明する。まず、二つの深溝型玉軸受８，８の両外輪８ａ，８ａが近接する向きに移動できないように両外輪８ａ，８ａのフランジ１５，１５の内側面を遊星ローラ３の端面に当接配置させる。このとき、遊星ローラ３の端面間距離（遊星ローラ長さ）および両外輪８ａ，８ａの端面間距離

5

（外輪長さ）は、それぞれの端面が精度よく加工されているので、正確に寸法設定されうる。次いで、ディスタンスピース１６の長さを正確に寸法設定されている両外輪８ａ，８ａ間の軸方向離間距離に比べて所望寸法短く設定し、フリー状態の遊星軸７に遊星ローラ３を取り付ける。このように組み立ててから、遊星軸７をキャリアプレート５の挿通孔へ一杯まで押し込む。

【００１９】このように遊星軸７を押し込むと、両内輪８ｂ，８ｂの両内側面とディスタンスピース１６との各間に設けられている適当な隙間分について両内輪８ｂ，８ｂどうしがその両側のスペーサ１３およびＥリング１４でもって圧縮されて軸方向に近接するように変位させられることになる。これに対して、両外輪８ａ，８ａのフランジ１５，１５が遊星ローラ３の両端面に当接させられているので、内輪８ｂ，８ｂが変位した量に応じた予圧が深溝型玉軸受８，８に付与されるようになる。

【００２０】このように、本実施例の場合、ディスタンスピース１６の長さを特定するだけで、キャリアプレート５の挿通孔へ遊星軸７をそれが止まるまで押し込むように操作することによって、深溝型玉軸受８，８に付与する予圧を的確に設定することができる。

【００２１】図３に本発明の多段構造の遊星ローラ式動力伝達装置の実施例を示している。

【００２２】多段構造の遊星ローラ式動力伝達装置とは、要するに、前述したような変速機構部２０を軸方向隣り合わせに複数段結合して大きな変速比を得るようにしたものである。図例では、軸方向隣り合わせに三段の変速機構部２０Ａ，２０Ｂ，２０Ｃを設け、高速段（図中左側）の変速機構部２０Ａの遊星ローラ３それぞれに太陽軸２を内接させて、この高速段の変速機構部２０Ａのキャリア４の軸部６を中速段（図中真ん中）の変速機構部２０Ｂの太陽軸として遊星ローラ３それぞれに内接させ、低速段（図中右側）の変速機構部２０Ｃのキャリア４の軸部６を低速の入出力軸としている。本実施例では、特に、三段の変速機構部２０Ａ，２０Ｂ，２０Ｃのうち低速段の変速機構部２０Ｃにおける深溝型玉軸受８の取付構造だけを図１に示すものと同じにし、他の変速機構部２０Ａ，２０Ｂについては図４に示すものと同じにしている。もちろん、すべての変速機構部２０Ａ，２０Ｂ，２０Ｃにおける深溝型玉軸受８の取付構造だけを図１に示すものと同じにしてもよいし、また、低速段と中速段の変速機構部２０Ｃ，２０Ｂだけを図１に示すものと同じにしてもよい。また、各段に個別の固定輪１Ａ，１Ｂ，１Ｃを用いているが、これらは一体に構成してもよい。さらに、図例ではキャリア４の環状プレート５と軸部６とが一体になっているが、図２の例の同様に別体に構成してもよい。

【００２３】なお、前述の例では三段の変速構造としているが、その段数は特に限定されない。また、多段構造の遊星ローラ式動力伝達装置において、少なくとも低速段の変速機構部２０Ｃの深溝型玉軸受８をフランジ１５のない外輪８ａを用いた構成として、その代わりに、遊星ローラ３と深溝型玉軸受８との間に設ける微小隙間に接着剤などの弾性体を介入してもよい。この場合、接着剤の弾性でもって遊星ローラ３と遊星軸７との間の遊びが低減されることになり、結果として前述の図３に示すような構造と同様に、回転トルク変動を抑制できるようになる。

6

【００２４】ここで、図１に示すフランジ付きの深溝型玉軸受を用いる場合、図示しないが前述の接着剤を用いる場合について、減速機として利用するときの出力軸（キャリア４の軸部６）のねじりトルクとねじれ角との関係をそれぞれ図４，図５のグラフに示している。従来例のようにフランジ無しの深溝型玉軸受を用いる場合についてのねじり剛性（出力軸ねじりトルクと出力軸ねじれ角との関係）を図６のグラフに示している。これらのグラフには、入力軸とする太陽軸２を正・逆方向に反転させるスナッチバック動作を繰り返すことにより得た結果が表されており、傾きが少ない程、ねじり剛性が高いことを意味している。このスナッチバック動作において、出力軸負荷トルクを正・逆両回転方向ともにｍａｘ３．０〔Ｎ・ｍ〕まで与えている。結果的に、ねじり剛性は、フランジ付きの深溝型玉軸受を用いる場合、０．５５４×１０$^{-3}$〔ｒａｄ／Ｎ・Ｍ〕、接着剤を用いる場合、１．０４〔ｒａｄ／Ｎ・Ｍ〕、フランジ無しの深溝型玉軸受を用いる場合、１．３６〔ｒａｄ／Ｎ・Ｍ〕となり、フランジ付きの深溝型玉軸受を用いる場合だとねじり剛性が格段に向上することが明らかとなる。

【００２５】なお、フランジ付きの深溝型玉軸受を用いる場合での使用装置は、固定輪１の内径を７０ｍｍ、遊星ローラ３の外径を３１．１１１ｍｍ、太陽軸２の外径を７．７７８ｍｍとし、フランジ無しの深溝型玉軸受を用いる場合での使用装置は、固定輪１の内径を５０ｍｍ、太陽軸２の外径を１０ｍｍ、遊星ローラ３の外径を２０ｍｍとしており、出力軸となるキャリア４の軸部６でのバックラッシ量は、フランジ付きの深溝型玉軸受を用いる場合、１．６×１０$^{-5}$〔ｒａｄ（３．４５秒）〕、接着剤を用いる場合、２．８７秒、フランジ無しの深溝型玉軸受を用いる場合、４２．７秒になる。このように使用装置毎に寸法が異なる場合を挙げているけれども、同一寸法とする場合でも前述とほぼ同様の傾向になるものと考えられる。

【００２６】

【発明の効果】本発明によれば、両外輪間の軸方向離間間隔に対する円筒部材の軸方向長さの割合を任意に特定することにより、二つの深溝型玉軸受に付与する予圧を調整することができる。つまり、本発明では、円筒部材の軸方向長さを特定するだけで、内輪どうしの軸方向圧縮力を微妙に加減操作することなく、予圧を的確に設定できるようになっており、予圧調整を、熟練者でなくと

7

も簡単にかつ正確に行うことができるなど、実用性に優れている。このため、遊星ローラ式動力伝達装置の組み立て時間を短縮できて、生産性アップに貢献できる。

【００２７】また、本発明の多段構造の遊星ローラ式動力伝達装置では、それを微小送り装置の減速機として利用する場合、遊びが大きく影響する低速段の変速機構部についての予圧調整が前述のように適正に管理できるようになるから、送り誤差を低減できるようになる。

【図面の簡単な説明】

【図１】本発明の要部である遊星ローラの周辺を示す縦断側面図。

【図２】遊星ローラ式動力伝達装置の基本的な構成を示す縦断側面図。

【図３】本発明の多段構造の遊星ローラ式動力伝達装置の上半分の縦断側面図。

【図４】図１のねじり剛性を表すグラフ。

【図５】図３のねじり剛性を表すグラフ。

8

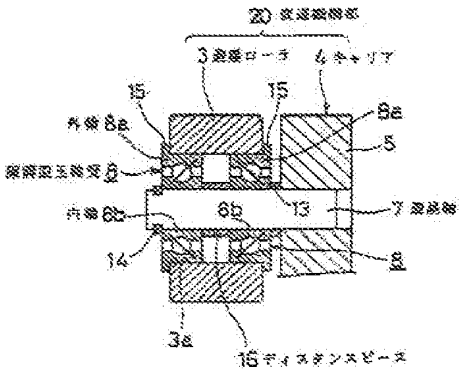
【図６】図７のねじり剛性を表すグラフ。

【図７】従来例の要部である遊星ローラの周辺を示す縦断側面図。

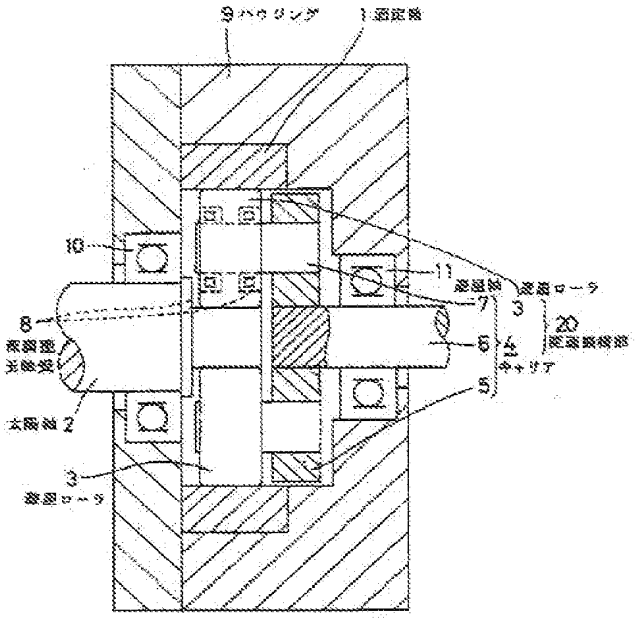
【符号の説明】

１	固定輪
２	太陽軸
３	遊星ローラ
４	キャリア
７	遊星軸
８	深溝型玉軸受
８ａ	深溝型玉軸受８の外輪
８ｂ	深溝型玉軸受８の内輪
１２	Ｃリング
１４	Ｅリング
１５	外輪８ａのフランジ
１６	ディスタンスピース

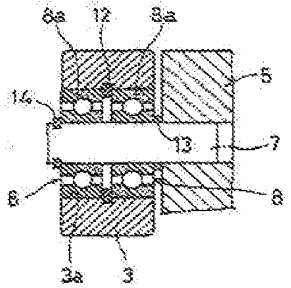
【図１】



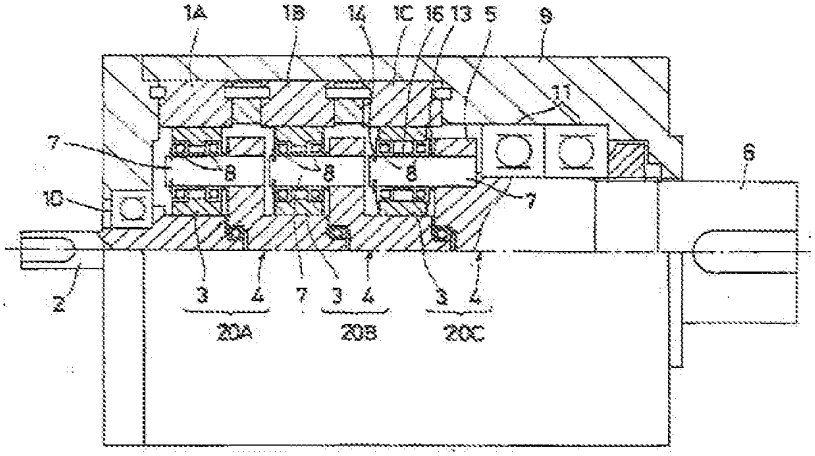
【図２】



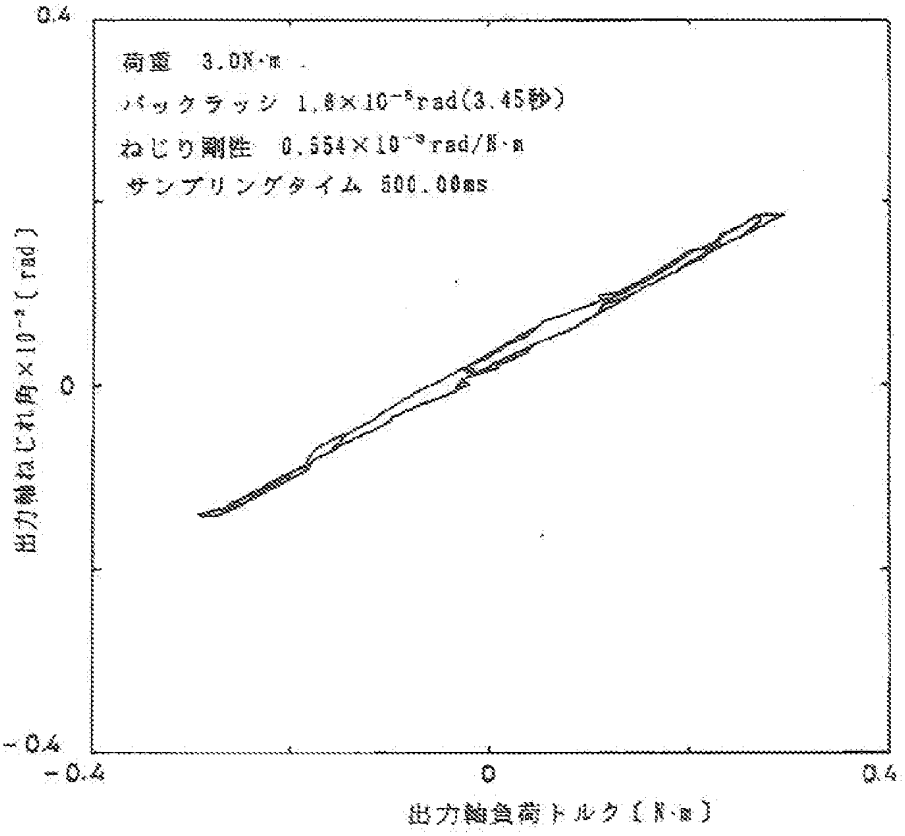
【図７】



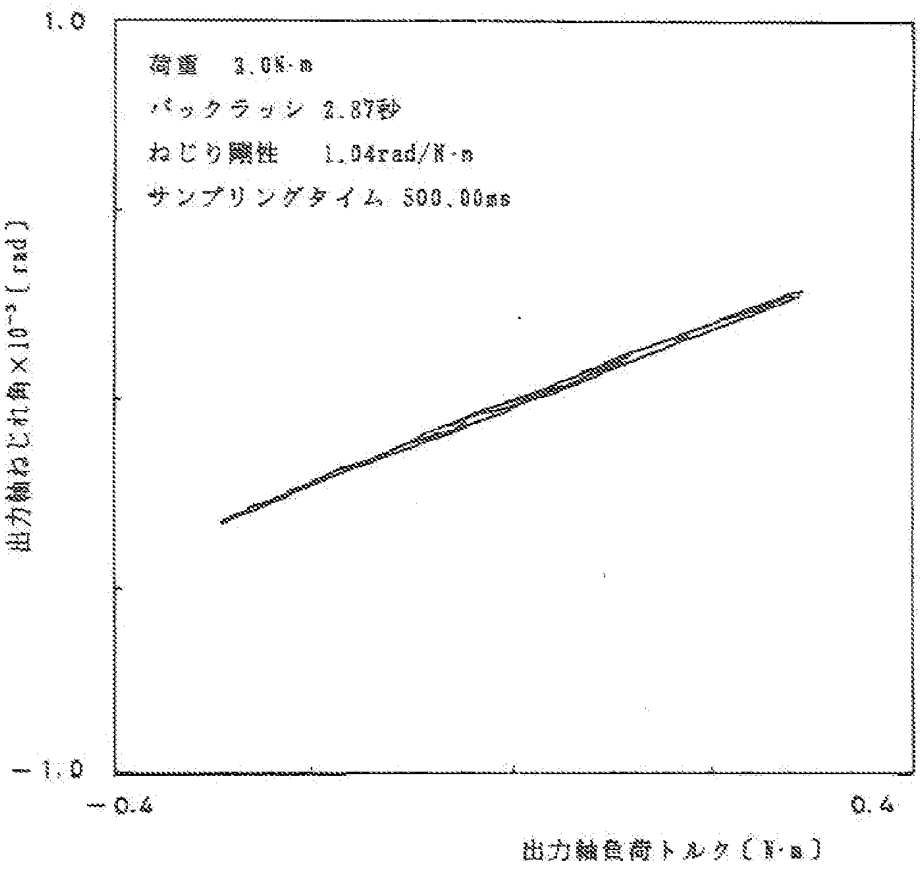
【図3】


1A
1B
1C
16
13
5
9
11
7
8
6
15
2
3
4
20A
20B
20C

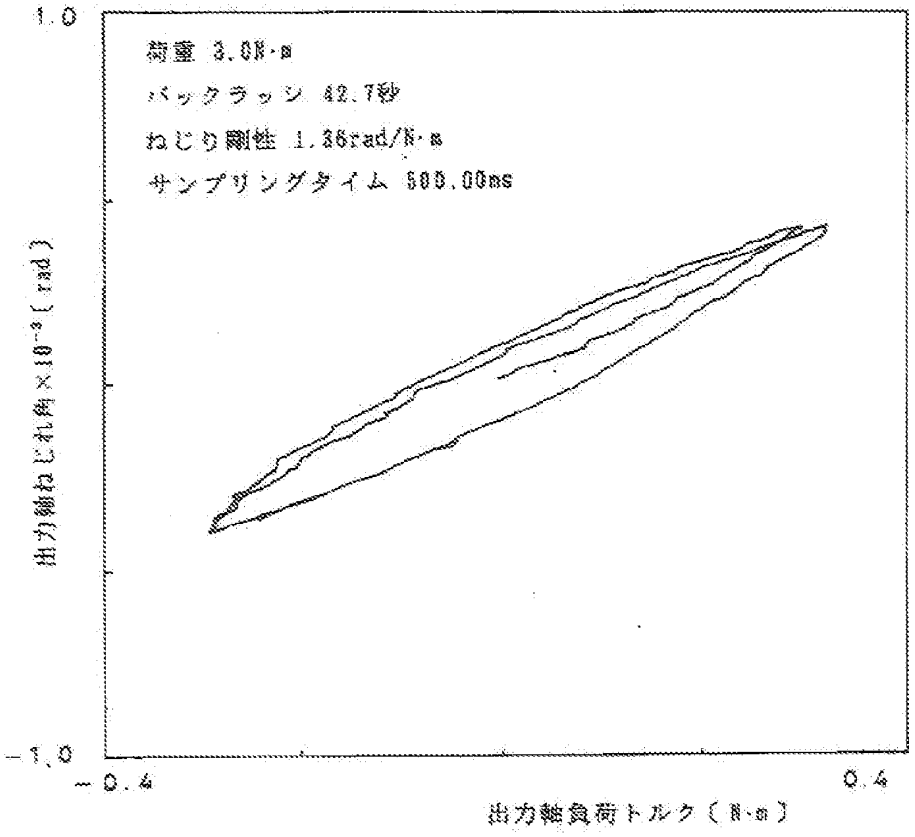
【図4】


荷重　3.0N·m
バックラッシ　1.8×10⁻⁵rad(3.45秒)
ねじり剛性　0.554×10⁻³rad/N·m
サンプリングタイム　500.00ms
出力軸ねじれ角×10⁻³〔rad〕
0.4
0
-0.4
-0.4
0
0.4
出力軸負荷トルク〔N·m〕

【図5】


1.0
荷重　3.0N·m
バックラッシ 2.87秒
ねじり剛性　1.04rad/N·m
サンプリングタイム 500.00ms
出力軸ねじれ角×10⁻³〔rad〕
－1.0
－0.4
0.4
出力軸負荷トルク〔N·m〕

【図6】


1.0
荷重 3.0N·m
バックラッシ 42.7秒
ねじり剛性 1.36rad/N·m
サンプリングタイム 500.00ms
出力軸ねじれ角×10⁻³〔rad〕
−1.0
−0.4
0.4
出力軸負荷トルク〔N·m〕